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Is it time for 3D visualisation (?) – illustrations using a new algorithm for jet core identification

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Three scientific advances are starting to make the use of 3D visualisation in operational forecasting both tractable and beneficial. Firstly, new techniques from the visualisation community have overcome the historical limitations of 3D visualisation on 2D computer screens - specifically the true locations of features in the horizontal and vertical are now much more clearly portrayed. Secondly advances in computer technology, mainly derived from the gaming industry, and encapsulated in modern-day graphics cards, now allow for transparency, fly through, re-orientation and animation of complex 3D model atmosphere scenes in real time. And thirdly one can use relatively new feature identification techniques to represent the salient atmospheric features (e.g. cyclones, trough lines, jet cores, fronts) as points, strings or surfaces in 3D space. These algorithms compress large volumes of synoptically relevant gridded data into a very compact yet meaningful form, and likewise dramatically reduce obscuration of other aspects of interest. Together these three advances can allow the forecaster and researcher alike to quickly establish a clear 3D picture of the key features of the model atmosphere, and their evolution in time. For some aspects one can even visualise the 4D behaviour of multiple ensemble members.

This presentation will illustrate how the above advances are brought together in the open-source, interactive 3D meteorological visualisation tool “Met.3D” (http://met3d.readthedocs.org), showing in particular how a new algorithm for identifying jet cores in 3D as “strings” performs in this environment. The jet core algorithm builds on techniques initially introduced to identify and plot weather features (e.g. fronts) as line segments in 2 dimensions, by extending and adapting the mathematics to 3 dimensions. It derives from a momentum-based definition of a jet core line; the algorithm will be briefly described in the presentation.

To illustrate applications we will first show how the process of portraying jet stream cores on significant weather (SIGWX) charts used by aviation can be simplified. We will also show how new insights can be gained into 3D atmospheric interactions, using a case of extra-tropical cyclone transition from 2016. And there will also be an illustration of how jet stream core ‘bundles’ can be derived from the 51-member ECMWF ensemble and portrayed in a meaningful way.